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Earth and Space Data Computing Division
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In This Issue

NASA Center for Computational Sciences

- Powerful New Computing Systems 1
- New Online User Services 2

Computational Technologies

- Reshaping NASA Science Modeling 2

Computational Optics

- Futuristic Astronomic Imaging Systems 3

Scientific Visualization Studio

- ESDCCD Updates 3

Powerful New Systems Available for NCCS User Community

Supercomputer Dedication



Nancy Palm (center), Science Computing Branch Head, with the integration team at the dedication.

Photo credit: Judy Laue/AMTI.

The NASA Center for Computational Sciences (NCCS) is pleased to announce the availability of a powerful new Compaq AlphaServer SC45. With a peak performance of 1 TeraFLOPS, the 512-processor system is approximately fifty percent faster than the NCCS' previously most powerful system, the Cray T3E. The new system will enable users to run current versions of their models much faster as well as move to their next generation models. Each 1-GHz processor on the AlphaServer is twice as powerful as a single processor on the general users' Cray SV1. The Compaq is also 2.5 times faster than the SGI Origin 3800 that was

installed in July 2001 for use by the Data Assimilation Office (DAO) and Goddard Institute for Space Studies (GISS) communities.

The NCCS officially dedicated its new Compaq AlphaServer SC45 on July 10. The 512-processor system along with a small test system was named after Milton Halem, former Chief of the ESDCCD and long-time advocate of high-end computing at Goddard. The system is currently tied for #37 on the June 2002 TOP500



Richard Rood (left) and Milton Halem (right) holding dedication plaques at the ceremony. Photo credit: Debbie McCallum.

Supercomputer Sites list and may move into the top 10 this September when its capacity more than triples. According to Richard Rood, Acting Chief of the ESDCCD, the AlphaServer will enable climate simulation on an unprecedented time-scale of centuries.

At the Compaq's dedication, Mary Cleave, NASA Deputy Associate Administrator for Earth Science, spoke of how this system will advance research in Earth science. She remarked that the Compaq will enable science teams to produce research-quality assimilated global data sets from multiple satellites and perform ensemble simulations coupling high-resolution atmospheric and oceanic models to help scientists better understand powerful phenomena, such as El Niño-La Niña. Additionally, she said it will permit researchers to embark on climate studies focusing on timescales ranging from a decade to a century with a specialty in exploring the natural and human influences on global warming.

The migration of the user community workload began this summer with the NASA Seasonal-to-Interannual Prediction Project (NSIPP), GISS, and the major users of the Cray SV1, the NCCS general use machine. NCCS support staff also assisted

with porting the computationally intensive codes of other users such as the DAO.

NSIPP is the primary user of the initial 512 processors. The DAO will become another primary user when an additional 880 1.25 GHz processors are installed this Fall. This addition will boost the system's peak performance by over 2 TeraFLOPS to 3.2 TeraFLOPS, more than four times as powerful as the Cray T3E. To increase the bandwidth between the NCCS systems and mass storage, the NCCS upgraded its internal LAN to Gigabit Ethernet. The network switch supports up to 120 one-gigabit/second (Gb/s) connections.

In early April GISS received a separate 32-processor Compaq AlphaServer SC45 at its New York location. This NCCS computing resource nearly doubled the institute's computational power. The ESDCD installed an OC3 (155 Mb/s) communications line that connected GISS to the NCCS for enhanced distributed computing, data storage, and scientific visualization.

<http://esdcd.gsfc.nasa.gov/scb-public/nccs.welcome.html>

NCCS: Online User Services

New NCCS Web-based Accounting and Authorization

A new Web-based system provides accounting and utilization information for all the NCCS high-end systems. Users, sponsors, division representatives, and funding managers may all obtain information about system use for their authorized accounts. The information, updated daily, is available for the current month, previous months, and fiscal year to date. The system features drill-down capability to the job level. Existing users may update their personal information.

A valid NCCS userid and accounting access Personal Identification Number (PIN) is required for access. Users may obtain or change their PIN by contacting the Office Of User Administration at 301-286-9367 or usradm@nccs.gsfc.nasa.gov. Web pages are available to automate the fiscal year change-over for sponsors, division representatives, and funding managers. FY2003 planned changes to system and storage allocations are reflected in the system. To access this system, go to the NCCS User Services Web page:

<http://nccstag.gsfc.nasa.gov>

Additionally, new users may apply for IDs on NCCS systems from a public Web site:

<http://esdcd.gsfc.nasa.gov/scb-public/nccs.welcome.html>

Computational Technologies Project

New Partnerships Set to Reshape NASA Science Modeling

For nearly a decade, the Earth Science Technology Office (ESTO) Computational Technologies (CT) Project (formerly known as the HPCC ESS Project) has been expanding the nation's ability to apply high-performance computers to difficult problems that scientists cannot solve by other means.

Over the next 3 years, the project is joining with leading university and government researchers to develop software frameworks that will enable more realistic simulations of natural phenomena and interpretation of vast quantities of observational data on these powerful machines.

NASA will pay out \$22.8 million to 11 investigation teams attacking challenges as diverse as:

- making it possible for most climate and weather modeling groups to share and reuse each other's software
- creating multi-year earthquake forecasts
- simulating how invasive plant species spread in national parks and wilderness areas
- predicting space weather using real-time observations
- uncovering the workings of gamma-ray bursts
- deploying an on-demand image mosaic service for the National Virtual Observatory

Teams led by the National Center for Atmospheric Research, the Massachusetts Institute of Technology, and GSFC are undertaking the largest endeavor of CT Round-3 to date. They are building a prototype software infrastructure to enable the nation's most widely used climate and weather models and assimilation systems to readily operate together.

The partners expect this "Earth System Modeling Framework" to reshape the national modeling community by significantly reducing the effort researchers must expend on developing software. The framework will improve the fidelity and predictive capability of the models by making it much simpler to swap and compare alternative scientific approaches from many different sources.

All investigations will transfer the new capabilities to customers at NASA centers and in the wider science community. <http://ct.gsfc.nasa.gov>

Computational Optics

Finding the Precursors to Life: Futuristic Astronomic Imaging Systems

Through the 2.4-meter, single-aperture Hubble Space Telescope (HST), we can see up to 10 billion light years away from Earth. Now, NASA scientists are conceiving fantastic new imaging-in-space concepts to help answer the questions: Where do we come from? Are we alone? These concepts include new technologies using ultra-lightweight telescopes, formation flying, and interferometry.

A team including NASA GSFC scientists, Richard Lyon and Daniel Gezari, won two awards: an 18-month and the follow-on to study various techniques for the Terrestrial Planet Finder mission. Their Visible Light Coronagraph concept—a large optical telescope with a mirror three to four times bigger and at least 10 times more precise than the HST—is one of the two candidate architectures for the mission. It is anticipated that one of these two architectures will be selected in 2005 or 2006 to be implemented for the mission, scheduled for launch by the middle of the next decade.

Lyon is also developing the following three optical imaging R&D testbeds to take new ideas from concept through ground laboratory simulation, making them viable concepts for flight in about 10 years.

Testbed 1: The Phase Diverse Imaging Testbed funded through NASA GSFC's Independent Research and Development (IRAD) Program, uses three moving apertures to emulate three moving spacecraft flying in formation. This testbed will be used to evaluate techniques for maintaining optical alignment and phase of spacecraft while imaging.

Testbed 2: The Fizeau Interferometer Testbed, funded through IRAD and NASA HQ, will continue the work of the first testbed, but with up to 30 apertures emulating 30 separate spacecraft and with optical closed loop control.

Testbed 3: A Holographic Speckle Corrected Telescope, funded through GSFC's Director's Discretionary Fund (DDF), will demonstrate use of holographic techniques to optimize coronagraphic imaging techniques for planet detection.

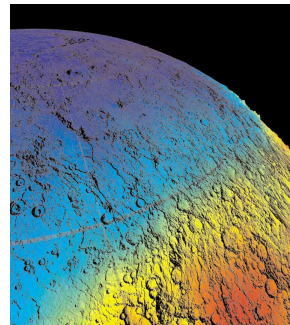
These endeavors are a challenging proposition both in space and on the ground, requiring supercomputer support. Lyon is using the ESDCD's Beowulf cluster for the actual control system as well as modeling, simulation, and algorithm development. A

direct spinoff of previous work on HST, this work will be ongoing for the Next Generation Space Telescope and other future NASA missions.
Email: Richard.G.Lyon.1@gsfc.nasa.gov

SVS

Media Visibility

The Scientific Visualization Studio (SVS) provides visualization products, systems, and expertise to a wide range of NASA projects and missions. SVS visualizations are regularly televised by national news shows and other broadcasts.



The July 5, 2002, cover of *Science*, Vol. 297, No. 5578, featured an SVS image of Mars. The image used data from the Mars Odyssey Gamma-Ray Spectrometer and the Mars Global Surveyor Mars Orbiter Laser Altimeter.

Image credit: Greg Shirah/SVS, Bill Boynton/University of Arizona.

The SVS created a process for producing seamless digital zooms

into cities, compositing imagery from several satellites. The largest-scale Earth imagery in the zooms is from the Moderate Resolution Imaging Spectroradiometer (MODIS) instrument on Terra, with resolutions from 8,000–250 meters. Next, Landsat 7 images resolve features to 15 meters. Finally, IKONOS images are used as the target area is approached, and objects as small as 1 meter are revealed. SVS zooms have received high media visibility, including broadcasts during Superbowl XXXVI and the 2002 Olympic Winter Games.

<http://svs.gsfc.nasa.gov>

ESDCD Updates

Space Hope

Space Hope, an outreach program led by Marilyn Mack, addresses the shortage of trained information technology (IT) professionals by providing disadvantaged persons with free or relatively inexpensive IT training.

The pilot program is a partnership outlined in a Memorandum of Understanding between NASA and the Greater Baltimore Alliance. Initially, the project was funded by NASA HQ. Additional funding as well as all funding beyond 5 years will come from grants and contributions from participating businesses.

Training (an A+ Certification class) for the pilot program is upcoming at a Space Hope satellite school—Morgan State University in Baltimore. Coppin State College is slated to participate as the program's core school.

<http://space-hope.gsfc.nasa.gov/home.html>

Refining the GLOBE Visualization Server

The Global Observations to Benefit the Environment (GLOBE) program has proven to be a highly popular on-line science site, with over 11,000 teachers from 97 countries trained to bring the Web site into classrooms across the world.

GLOBE's scientific visualization staff, managed by David Batchelor, is continually refining GLOBE's visualization server to keep the program useful and engaging to students. The server provides automated maps and graphs of the environmental data collected by students worldwide. Reference data from other scientific observations, computer models, and satellites in Earth orbit are also available. The visualization experts have created many automated features including comparative graphs, enhanced map controls, color control, spreadsheets, and VRML 3D maps. <http://viz.globe.gov>

Nearly 50 Summer Faculty and Students Hosted

This summer Code 930 hosted nearly 50 visiting faculty and students who were participating in educational programs managed by NASA, GSFC, and the ESDCD. Participants worked with GSFC researchers on projects involving information technology, computer science, and Earth and space sciences.

Sixteen graduate students participated in the ESDCD's 2002 NASA Summer School for High Performance Computational Earth and Space Sciences. The program provides educational opportunities to train the next generation of computational physicists focusing on Earth and space sciences in scalable parallel techniques and algorithm development. Students were given hands-on parallel computer training, small group interaction, and lectures on advanced topics in computational Earth and space sciences by Code 930 and other expert personnel. http://ct.gsfc.nasa.gov/summer_school.html

Twenty-five graduate, undergraduate, and high school students participated in this year's Visiting Student Enrichment Program (VSEP), managed by Marilyn Mack. Each student worked with GSFC mentors on a computer-related project for 10 weeks

and produced a formal written Web report, gave an oral presentation to peers and mentors, and attended lectures, tours, and field trips. Six of the students were from the City University of New York and were sponsored by the Minority University-Space Interdisciplinary Network (MU-SPIN) program.

<http://esdcd.gsfc.nasa.gov/VSEP>

Two visiting faculty were affiliated with NASA's Summer Faculty Fellowship Program (SFFP). Benita Bell, a chemistry professor from Bennett College, Greensboro, NC, worked with MU-SPIN in coordinating a collaboration of minority institutions in astrobiology. Junping Wang, a professor of applied mathematics at the Colorado School of Mines, Golden, CO, worked with the NCCS in developing a new algorithm to improve performance of data assimilation.

ESDCD personnel also mentored several students from both the GSFC Summer High School Apprenticeship Research Program (SHARP) and the Summer Institute in Engineering and Computer Applications (SIECA).

Awards, Grants, Inventions, and Degrees

The GSFC 2002 Information Science & Technology Award was presented to John Dorband for his contributions in scalable parallel computers. He helped to create the world's first Beowulf system, built at the ESDCD in 1994, and devised techniques for restoring Hubble images. <http://isanditcolloq.gsfc.nasa.gov>

"The National Invasive Species Forecasting System: A Strategic NASA/USGS Partnership to Manage Biological Invasions" by John Schnase and James Smith/GSFC Laboratory for Terrestrial Physics was selected for inclusion in NASA's FY2004 budget request.

A new mission architecture concept was selected for further study and technological development by NASA's Terrestrial Planet Finder project. Richard Lyon, a member of the selected team, has been researching Visible Light Coronagraphic techniques for a large optical telescope that will reduce observed starlight by a factor of up to 1 billion to enable astronomers to detect faint planets. http://www.jpl.nasa.gov/releases/2002/release_2002_113.html

Jacqueline Le Moigne filed an invention disclosure for "An Image Registration Toolbox."

Jerome Bennett, Associate Chief of the ESDCD and Acting Branch Head for the Science Communications Technology Branch, is one of

seven Goddard employees recently selected for the NASA Senior Executive Service Candidate Development Program (SESCDP). The purpose of the SESCDP is to develop a cadre of men and women who have high potential for assuming executive responsibilities to fill NASA SES positions. SESCDP provides formal courses and seminars, developmental work assignments, and individual mentoring from current SES members.

George Rumney earned a Master of Arts Degree in Geography, with a focus in Paleoclimatology, in May 2002 from the University of Maryland, College Park. GSFC and Code 900 sponsored the degree through GSFC's part time graduate study program.

Networking Forefronts

Pat Gary, Networking Project Manager and leader of the High End Computer Network (HECN) Team, was interviewed by Federal Computer Week for an article about cable types.

<http://www.fcw.com/fcw/articles/2002/0218/tec-gig-02-18-02.asp>

The HECN Team, with Bill Fink as technical lead, assisted the "electronic" Very-Long Baseline Interferometry (e-VLBI) project by implementing a 1 Gb/s end-to-end network between GSFC and the Haystack Observatory in Massachusetts.

Interactive Web Site on Mars Mission

Marcella Hopkins produced the "The Vikings of Mars" Web site. This educational site revisits the mid-1970's Viking Mars Lander Project, which stimulated questions regarding life on other planets.

This site is dedicated to the late Gerald Soffen, who led the Viking science team that performed the first experiments on the surface of Mars.

http://code935.gsfc.nasa.gov/project_six/Vindex.htm

MU-SPIN and METNET Team with Maine's Native American Schools

NASA's MU-SPIN program, managed by James Harrington, brings unique opportunities to minority students and teachers that increase their participation in NASA-related research. MU-SPIN recently announced that METropolitan NETwork (METNET), a network of weather stations at New York metropolitan area schools, installed weathercams at the three Native American schools that make up the Maine Indian Education School System. This expansion offers students an opportunity to compare urban and rural weather data and increases MU-SPIN's outreach efforts to the Native American community. <http://muspin.gsfc.nasa.gov>

Web Map Viewer Software Released

NASA Web Map Viewer software, developed by Jeff de La Beaujardiere, was approved for distribution to U.S. Government agencies by the GSFC Software Release Manager. The Viewer accesses maps from a global distributed network of servers that obey the Open GIS Consortium's Web Map Service Interface Specification. <http://viewer.digitalearth.gov>

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